



## Concept: The Meaning of Exponents

Name: \_\_\_\_\_

### Warm Up

Complete the following. Show all your steps.

(a)  $2 \times 2 \times 2 \times 2 = \underline{16}$

(b)  $2 \times 2 \times 2 = \underline{8}$

(c)  $2 \times 2 \times 2 \times 2 \times 2 = \underline{32}$

(d)  $2 \times 2 \times 2 \times 2 \times 2 \times 2 = \underline{64}$

### COMPUTER COMPONENT

**Instructions:** Select the computer program *Understanding Exponents* (Neufeld)  
Follow the instructions to the Main Menu.  
Select *The Meaning of Exponents* from the Main Menu.



Work through all sections of this topic **in order**:

- *Introduction... The Money Game*
- *Introduction... Bacteria Doubling*
- *Introduction... Paper Folding*

**Notice:** You will not be finishing the entire topic before stopping to complete some **OFF COMPUTER EXERCISES**.

**Additional Required Materials:** Pencil crayons  
Rice



As you work through the computer exercises, make your notes in the **NOTES** section of this page.

When you reach the end of the section *Concepts – Examples without Tiles* on the computer, move on to the **OFF COMPUTER EXERCISES** below.

## The Chess Board

1. On square 1, place a grain of rice.
2. On square 2, place 2 grains of rice.
3. On square 3, place 4 grains of rice.
4. Continue to double the number.

### Task 1:

Complete the patterns as far as you can. Write the number of grains in the square.

### Task 2:

At the end of each row, indicate the kind of container that you would use to hold the rice. For example, at the end of the first row (square 8), a spoon might be used.

								Container
1	2	3	4	5	6	7	8	Spoon
1	2	4	8	16	32	64	128	
9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	
25	26	27	28	29	30	31	32	
33	34	35	36	37	38	39	40	
41	42	43	44	45	46	47	48	
49	50	51	52	53	54	55	56	
57	58	59	60	61	62	63	64	

**NOTES**

Fill in the following Chart. (The Money Games)

<b>Day Number</b>	<b>Prize A (\$100 per day)</b>	<b>Prize B (\$ 0.01 per day, double each day)</b>
1	\$100	\$0.01
2	\$200	\$0.02
3	\$300	\$0.04
4	\$400	\$0.08
5	\$500	\$0.16
6	\$600	\$0.32
7	\$700	\$0.64
8	\$800	\$1.28
9	\$900	\$2.56
10	\$1000	\$5.12
11	\$1100	\$10.24
12	\$1200	\$20.48
13	\$1300	\$40.96
14	\$1400	\$81.92
15	\$1500	\$163.84
16	\$1600	\$327.68
17	\$1700	\$655.36
18	\$1800	\$1310.72
19	\$1900	\$2621.44
20	\$2000	\$5242.88
21	\$2100	\$10485.76

Graph the results from the above chart. Place **Day** on the horizontal axis and **Money** on the vertical axis. (*Use different colored pencils for each Prize*)

Fill in the banks.

- According to my graph, on day 19 the value of Prize B exceeds the value of Prize A.
- Write an algebraic expression to represent how money (M) is related to days (D) for Prize A.

$$\underline{M = 21 \times \$100}$$

- Write an algebraic expression to represent how money (M) is related to days (D) for Prize B.

$$\underline{M = 2^{20}}$$

- Do the graphs for Prize A and Prize B represent linear or non-linear relationships?  
*Justify your answer.*

*Prize A- Linear*

*Prize B- Non-Linear*

Fill in the following Chart. (Paper Folding)



Number of folds	Number of Rectangles	Pattern
1	2	$1 \times 2$
2	4	$1 \times 2 \times 2$
3	8	$1 \times 2 \times 2 \times 2$
4	16	$1 \times 2 \times 2 \times 2 \times 2$
5	32	$1 \times 2 \times 2 \times 2 \times 2 \times 2$
6	64	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
7	128	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
8	256	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
9	512	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
10	1024	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
11	2048	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
12	4096	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
13	8192	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
14	16384	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
15	32768	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
16	65536	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
17	131072	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
18	262144	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
19	524288	$1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
20	1048576	$1 \times 2$
21	2097152	$1 \times 2$

Graph the results from the above chart. Place **Day** on the horizontal axis and **Money** on the vertical axis. (Use different colored pencils for each Prize)

**Fill in the blanks.**

- If we could fold the paper 50 times, the height would be  $2^{50}$  or 1125899907000000 layers high.
  
- If 100 sheets of paper are 1 cm high and each is folded 50 times, how high would the pile be?

$$\begin{aligned} \text{File} &= \frac{1125899907000000}{100} \times 100 \text{ or } \frac{2^{50}}{100} \times 100 \\ &= 1125899907000000 \text{ cm or } 11258999070000 \text{ m or } 1125899907000 \text{ km} \end{aligned}$$

**OFF COMPUTER EXERCISES**

1. Jamie was washing his cement patio. He used a bucket of soapy water to soak the area. As he dumped the first bucket, he noticed that every 2 seconds the area covered was doubled. At 20 seconds, the whole patio was covered with the solution. How long did it take to cover half of Jamie's patio? (*A chart/graph would help you answer this question.*)

*It took 18 seconds to cover half of Jamie's patio because the area would be doubled every two seconds.*